

Appendix G: Input deck to MAGICO-701

```
MAGICO-701 IFCI6.0H --- (01/27/95)
$ This is a simulation of the MIXA-06
$ begin general input section
$ restart file (1=yes,0=no)
0
$ time intervals
$ dump plot edit
5e-1 1e-2 5e-1
$ number of steps for main print (iprint>0)
1
$ print flags (3)
1 0 0
$ number of axial mesh cells
104
$ number of radial rings
10
$ radiation time step control (gascoef)
0.02
$ start time in sec
0.00
$ problem end time
1.0
$ initial time step
1.0e-8
$ number of entries (ntim) in table of maximum timestep versus time
2
$ entries in maximum time step table (ntim * (time, max time))
0.0 1.0e-3 25.0 1.0e-3
$***end general input section
$ begin fluids input
$ time step increase factor (if no other time step limitations present)
1.05
$ minimum time step
1.e-10
$ courant number to limit time step
0.25
$ minimum iterations to allow timestep increase
3
$ maximum iterations before failure
25
$ convergence error in pressure iteration (error1)
1.0e-7
$ maximum allowable relative change in volume fraction per time step
0.250
$ maximum allowable relative change in temperature per time step
0.050
$ condensation coefficient
```

```

1.0e-4
$ initial field 3 diameter dcor1
$ data irrelevant (field 3 not used)
0.0024
$ initial field 4 diameter dcor2
$ data from NURETH-5 report
0.0024
$ material id's (8 #s)
$ uo2(#1), and zro2(#4)
5 7*0
$
$*** following are additions to standard v52 melprog input
$ reference mass fractions for fields 3 and 4 (8 #s)
1.00 7*0.0
$ reference pressure
0.1e6
$ reference temperatures for fields 3 and 4 (2 #s)
800.0 800.0
$ inverse sound speed squared for fields 3 and 4 (2 #s)
$ same as default
2*1.0e-4
$
$ detonation flag and model selector
0 0 0
$ type 0 flag
$ 16 1 0.01
$ type 1 flag
$ 10.0e6
$ type 2 flag
$ 0.01 0.001
$ fragmentation data (to be input only if det model used)$
$ 0.001 0.00001 0 10.
$
$ number of time steps for minor print to ntty (1 line)
50
$ IIOUT, info print control (0 cycles thru)
8
$
$*** additive friction factors
$ number of additive regions
0
$*** end additive friction
$*** INFLOW BOUNDARIES
$ number of locations of inflow boundary conditions (ninbc)
5
$ ring number of inflow cell (INN)
1
$ axial location of inflow condition (NMAX+1)
105
$ flow area
1.256637e-3
$ number of entries in inflow pressure condition tables
2
$ number of entries in in inflow velocity tables
2
$ number of entries in inflow temperature tables

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2
$ number of entries in inflow volume fraction tables
2
$ inflow pressure table (time, pressure)
0.0 1.e5 100.0 1.e5
$ inflow hydrogen partial pressure table (time, pressure)
0.0 0.0 100.0 0.0
$ inflow velocity, temp, vol frac, and compos. table (time, *)
$ Field 1
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.975 100. 0.975
$ Field 2
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 3
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 4
0.0 -0.72 100. -0.72
0.0 823. 100.0 823.
0.0 0.0187 100. 0.0187
1.0 7*0.0
1.0 7*0.0
$ ring number of inflow cell (INN)
2
$ axial location of inflow condition (NMAX+1)
105
$ flow area
3.769911e-3
$ number of entries in inflow pressure condition tables
2
$ number of entries in in inflow velocity tables
2
$ number of entries in inflow temperature tables
2
$ number of entries in inflow volume fraction tables
2
$ inflow pressure table (time, pressure)
0.0 1.e5 100.0 1.e5
$ inflow hydrogen partial pressure table (time, pressure)
0.0 0.0 100.0 0.0
$ inflow velocity, temp, vol frac, and compos. table (time, *)
$ Field 1
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.975 100. 0.975
$ Field 2
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 3
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 4
0.0 -0.72 100. -0.72
0.0 823. 100.0 823.

```

```

0.0 0.0187 100. 0.0187
1.0 7*0.0
1.0 7*0.0
$ ring number of inflow cell (INN)
3
$ axial location of inflow condition (NMAX+1)
105
$ flow area
6.283185e-3
$ number of entries in inflow pressure condition tables
2
$ number of entries in in inflow velocity tables
2
$ number of entries in inflow temperature tables
2
$ number of entries in inflow volume fraction tables
2
$ inflow pressure table (time, pressure)
0.0 1.e5 100.0 1.e5
$ inflow hydrogen partial pressure table (time, pressure)
0.0 0.0 100.0 0.0
$ inflow velocity, temp, vol frac, and compos. table (time, *)
$ Field 1
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.975 100. 0.975
$ Field 2
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 3
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 4
0.0 -0.72 100. -0.72
0.0 823. 100.0 823.
0.0 0.0187 100. 0.0187
1.0 7*0.0
1.0 7*0.0
$ ring number of inflow cell (INN)
4
$ axial location of inflow condition (NMAX+1)
105
$ flow area
8.796459e-3
$ number of entries in inflow pressure condition tables
2
$ number of entries in in inflow velocity tables
2
$ number of entries in inflow temperature tables
2
$ number of entries in inflow volume fraction tables
2
$ inflow pressure table (time, pressure)
0.0 1.e5 100.0 1.e5
$ inflow hydrogen partial pressure table (time, pressure)
0.0 0.0 100.0 0.0
$ inflow velocity, temp, vol frac, and compos. table (time, *)
$ Field 1

```

```

0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.975 100. 0.975
$ Field 2
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 3
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 4
0.0 -0.72 100. -0.72
0.0 823. 100.0 823.
0.0 0.0187 100. 0.0187
1.0 7*0.0
1.0 7*0.0
$ ring number of inflow cell (INN)
5
$ axial location of inflow condition (NMAX+1)
105
$ flow area
1.130973e-2
$ number of entries in inflow pressure condition tables
2
$ number of entries in inflow velocity tables
2
$ number of entries in inflow temperature tables
2
$ number of entries in inflow volume fraction tables
2
$ inflow pressure table (time, pressure)
0.0 1.e5 100.0 1.e5
$ inflow hydrogen partial pressure table (time, pressure)
0.0 0.0 100.0 0.0
$ inflow velocity, temp, vol frac, and compos. table (time, *)
$ Field 1
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.975 100. 0.975
$ Field 2
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 3
0.0 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 100. 0.000
$ Field 4
0.0 -0.72 100. -0.72
0.0 823. 100.0 823.
0.0 0.0187 100. 0.0187
1.0 7*0.0
1.0 7*0.0
$*** end of inlet bc section *****
$*** outflow boundary conditions *****
$ Flow areas are areas of each annulus at top of problem domain.
$ HDs are delta-r's of each ring.

```

```

$ number of locations for outlet pressure boundaries (npbc)
4
$ boundary location flag
2
$ radial location of outlet bc
6
$ flow area for pressure bc
1.382301e-2
$ hydraulic diameter for pressure bc
0.5
$ number of entries in outlet pressure boundary condition table (nprout)
2
$ outlet pressure vs time (nprout*(time,press))
0.0 0.1e6 100.0 0.1e6
$ boundary location flag
2
$ radial location of outlet bc
7
$ flow area for pressure bc
1.633628e-2
$ hydraulic diameter for pressure bc
0.5
$ number of entries in outlet pressure boundary condition table (nprout)
2
$ outlet pressure vs time (nprout*(time,press))
0.0 0.1e6 100.0 0.1e6
$ boundary location flag
2
$ radial location of outlet bc
8
$ flow area for pressure bc
1.884956e-2
$ hydraulic diameter for pressure bc
0.5
$ number of entries in outlet pressure boundary condition table (nprout)
2
$ outlet pressure vs time (nprout*(time,press))
0.0 0.1e6 100.0 0.1e6
$ boundary location flag
2
$ radial location of outlet bc
9
$ flow area for pressure bc
2.136283e-2
$ hydraulic diameter for pressure bc
0.5
$ number of entries in outlet pressure boundary condition table (nprout)
2
$ outlet pressure vs time (nprout*(time,press))
0.0 0.1e6 100.0 0.1e6
$ boundary location flag
2
$ radial location of outlet bc
10
$ flow area for pressure bc
2.38761e-2
$ hydraulic diameter for pressure bc
0.5
$ number of entries in outlet pressure boundary condition table (nprout)

```

```

2
$ outlet pressure vs time (nprout*(time,press))
 0.0  0.1e6  100.0  0.1e6
$*** end outlet bc section
$ the following cards (to the end of fluids in) not included in restart
$*** fluid region input
$ number of fluid regions
 2
$ FLUID REGION 1 (water)
 1 1 10 65
$ initial system pressure (spatially uniform)
 0.1e6
$ initial hydrogen partial pressure
 0.0e6
$ initial fluid volume fractions (1 to nf)
 0.0001 0.999899  0.0  0.000001
$ initial composition for field 4
 1.0 7*0.0
$ initial temperatures (4 fluids)
 372.69  372.69  372.69  372.69
$ initial fluid axial velocities (1 to nf)
 0.0 2*0.0 0.0
$ initial fluid radial velocities (1 to nf)
 4*0.0
$ FLUID REGION 2 (vapor)
 1 66 10 104
$ initial system pressure (spatially uniform)
 0.1e6
$ initial hydrogen partial pressure
 0.0e6
$ initial fluid volume fractions (1 to nf)
 0.999999 0.0 0.0 0.000001
$ initial composition for field 4
 1.0 7*0.0
$ initial temperatures (4 fluids)
 372.69  372.69  372.69  372.69
$ initial fluid axial velocities (1 to nf)
 0.0 2*0.0 0.0
$ initial fluid radial velocities (1 to nf)
 4*0.0
$ volume fraction equivalent to zero
 1.e-16
$*** end fluid ic section
$*** vessel geometry
$ axial length of cell (m)
$ 16*0.025
 40*3.846154e-3,
 40*3.846154e-3,
 24*3.846154e-3
$ location of radial nodes, 1 to nrp1 (1 = 0.0)
 0.0 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20
$ additional embedded interface cell connections
 0
$*** structures input
$ structure input table size, convergence criteria, iterations
$ this has maxmod=0 to turn off structures input

```

```
$  
0 1.0e-6 1.0e-6 10 10  
$*** end structures  
$  
$*** radiation input  
$  
$ number of radiation groups  
1  
$ max number of iterations  
50  
$ convergence criteria  
1.0e-5  
$ tbound  
300.  
$ emissivities  
0.3 0.3 0.3 0.3 0.3 0.8  
$ mass absorption coefficient  
4*0.1  
$  
$*** end radiation  
$*** debris data  
0  
5 1 2  
0.8 0.70 0.08 0.0045 0.0  
$  
$*** end debris  
$*** end input deck ***  
$
```

Appendix H: Input deck to MIXA-6

```
MIXA-06 11x96, Flux model
$ This is a simulation of the MIXA-06
$ SCOPING CALCULATION
$ begin general input section
$ restart file (1=yes,0=no)
0
$ time intervals
$ dump plot edit
1e-0 2e-2 5e-1
$ number of steps for main print (iprnt>0)
1
$ print flags (3)
1 0 0
$ number of axial mesh cells
96
$ number of radial rings
11
$ radiation time step control (gascoef)
0.02
$ start time in sec
0.00
$ problem end time
2.0
$ initial time step
1.0e-8
$ number of entries (ntim) in table of maximum timestep versus time
2
$ entries in maximum time step table (ntim * (time, max time))
0.0 1.0e-3 25.0 1.0e-3
$***end general input section
$ begin fluids input
$ time step increase factor (if no other time step limitations present)
1.05
$ minimum time step
1.e-10
$ courant number to limit time step
0.25
$ minimum iterations to allow timestep increase
3
$ maximum iterations before failure
25
$ convergence error in pressure iteration (error1)
1.0e-7
$ maximum allowable relative change in volume fraction per time step
0.250
$ maximum allowable relative change in temperature per time step
0.050
$ condensation coefficient
```

```

1.0
$ initial field 3 diameter dcor1
$ data irrelevant (field 3 not used)
0.0060
$ initial field 4 diameter dcor2
$ data from NURETH-5 report
0.006
$ material id's (8 #s)
$ uo2(#1), and zro2(#4)
1 4 6*0
$
$*** following are additions to standard v52 melprog input
$ reference mass fractions for fields 3 and 4 (8 #s)
0.80 0.20 6*0.0
$ reference pressure
0.1e6
$ reference temperatures for fields 3 and 4 (2 #s)
3000.0 3000.0
$ inverse sound speed squared for fields 3 and 4 (2 #s)
$ same as default
2*1.0e-4
$
$ detonation flag and model selector
0 0 1
$ type 0 flag
$ 16 1 0.01
$ type 1 flag
$ 10.0e6
$ type 2 flag
$ 0.01 0.001
$ fragmentation data (to be input only if det model used)$
$ 0.001 0.00001 0 10.
$
$ number of time steps for minor print to ntty (1 line)
50
$ IIOUT, info print control (0 cycles thru)
8
$
$*** additive friction factors
$ number of additive regions
1
$ region 3 domain
3,89,3,96
$ Additive axial friction factor at top of node for field 1 (vapor)
8*0.0
$ Additive axial friction factor at top of node for field 2 (water)
8*0.0
$ Additive axial friction factor at top of node for field 3
8*0.0
$ Additive axial friction factor at top of node for field 4 (melt)
8*0.0
$ Additive axial friction factor at rhs of node for field 1 (vapor)
8*1.e21
$ Additive axial friction factor at rhs of node for field 2 (water)
8*1.e21
$ Additive axial friction factor at rhs of node for field 3
8*1.e21
$ Additive axial friction factor at rhs of node for field 4 (melt)
8*1.e21

```

```

$*** end additive friction
$ 
$*** INFLOW BOUNDARIES
$ 
$ number of locations of inflow boundary conditions (ninbc)
3
$ ring number of inflow cell (INN)
1
$ axial location of inflow condition (NMAX+1)
97
$ flow area
1.25664e-3
$ number of entries in inflow pressure condition tables
2
$ number of entries in in inflow velocity tables
4
$ number of entries in inflow temperature tables
2
$ number of entries in inflow volume fraction tables
6
$ inflow pressure table (time, pressure)
0.0 1.e5 100.0 1.e5
$ inflow hydrogen partial pressure table (time, pressure)
0.0 0.0 100.0 0.0
$ inflow velocity, temp, vol frac, and compos. table (time, *)
$ Field 1
0.0 0.0 1.5 0.0 1.51 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.96435 0.43 0.96435 0.431 0.96161 1.5 0.96161 1.501 1.000 100. 1.000
$ Field 2
0.0 0.0 1.5 0.0 1.51 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 0.43 0.0000 0.431 0.0000 1.5 0.0000 1.501 0.000 100. 0.000
$ Field 3
0.0 0.0 1.5 0.0 1.51 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 0.43 0.0000 0.431 0.0000 1.5 0.0000 1.501 0.000 100. 0.000
$ Field 4
0.0 -0.57131 1.5 -0.57131 1.51 0.0 100. 0.0
0.0 3600. 100.0 3600.
0.0 0.03565 0.43 0.03565 0.431 0.038392 1.5 0.038392 1.501 0.000 100. 0.000
0.80 0.20 6*0.0
0.80 0.20 6*0.0
$ ring number of inflow cell (INN)
2
$ axial location of inflow condition (NMAX+1)
97
$ flow area
3.76991e-3
$ number of entries in inflow pressure condition tables
2
$ number of entries in in inflow velocity tables
4
$ number of entries in inflow temperature tables
2
$ number of entries in inflow volume fraction tables
6
$ inflow pressure table (time, pressure)
0.0 1.e5 100.0 1.e5
$ inflow hydrogen partial pressure table (time, pressure)

```

```

0.0 0.0 100.0 0.0
$ inflow velocity, temp, vol frac, and compos. table (time, *)
$ Field 1
0.0 0.0 1.5 0.0 1.51 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.96435 0.43 0.96435 0.431 0.96161 1.5 0.96161 1.501 1.000 100. 1.000
$ Field 2
0.0 0.0 1.5 0.0 1.51 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 0.43 0.0000 0.431 0.0000 1.5 0.0000 1.501 0.000 100. 0.000
$ Field 3
0.0 0.0 1.5 0.0 1.51 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 0.43 0.0000 0.431 0.0000 1.5 0.0000 1.501 0.000 100. 0.000
$ Field 4
0.0 -0.57131 1.5 -0.57131 1.51 0.0 100. 0.0
0.0 3600. 100.0 3600.
0.0 0.03565 0.43 0.03565 0.431 0.038392 1.5 0.038392 1.501 0.000 100. 0.000
0.80 0.20 6*0.0
0.80 0.20 6*0.0
$ ring number of inflow cell (INN)
3
$ axial location of inflow condition (NMAX+1)
97
$ flow area
6.28319e-3
$ number of entries in inflow pressure condition tables
2
$ number of entries in inflow velocity tables
4
$ number of entries in inflow temperature tables
2
$ number of entries in inflow volume fraction tables
6
$ inflow pressure table (time, pressure)
0.0 1.e5 100.0 1.e5
$ inflow hydrogen partial pressure table (time, pressure)
0.0 0.0 100.0 0.0
$ inflow velocity, temp, vol frac, and compos. table (time, *)
$ Field 1
0.0 0.0 1.5 0.0 1.51 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.96435 0.43 0.96435 0.431 0.96161 1.5 0.96161 1.501 1.000 100. 1.000
$ Field 2
0.0 0.0 1.5 0.0 1.51 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 0.43 0.0000 0.431 0.0000 1.5 0.0000 1.501 0.000 100. 0.000
$ Field 3
0.0 0.0 1.5 0.0 1.51 0.0 100. 0.0
0.0 372.69 100.0 372.69
0.0 0.0000 0.43 0.0000 0.431 0.0000 1.5 0.0000 1.501 0.000 100. 0.000
$ Field 4
0.0 -0.57131 1.5 -0.57131 1.51 0.0 100. 0.0
0.0 3600. 100.0 3600.
0.0 0.03565 0.43 0.03565 0.431 0.038392 1.5 0.038392 1.501 0.000 100. 0.000
0.80 0.20 6*0.0
0.80 0.20 6*0.0
$*** end of inlet bc section *****
$***
$*** outflow boundary conditions *****

```

```

$ Flow areas are areas of each annulus at top of problem domain.
$ HDs are delta-r's of each ring.
$ number of locations for outlet pressure boundaries (npbc)
 1
$ boundary location flag
 2
$ radial location of outlet bc
 11
$ flow area for pressure bc (based on 100mm vent pipe)
 0.0049497
$ hydraulic diameter for pressure bc
 0.1
$ number of entries in outlet pressure boundary condition table (nprout)
 2
$ outlet pressure vs time (nprout*(time,press))
 0.0 0.1e6 100.0 0.1e6
$ **** end outlet bc section
$ the following cards (to the end of fluids in) not included in restart
$*** fluid region input
$ number of fluid regions
 2
$ FLUID REGION 1 (water)
 1 1 11 80
$ initial system pressure (spatially uniform)
 0.1e6
$ initial hydrogen partial pressure
 0.0e6
$ initial fluid volume fractions (1 to nf)
 0.0001 0.9999 0.0 0.0
$ initial temperatures (4 fluids)
 372.69 372.69 3600.0 3600.0
$ initial fluid axial velocities (1 to nf)
 0.0 2*0.0 0.0
$ initial fluid radial velocities (1 to nf)
 4*0.0
$ FLUID REGION 2 (vapor)
 1 81 11 96
$ initial system pressure (spatially uniform)
 0.1e6
$ initial hydrogen partial pressure
 0.0e6
$ initial fluid volume fractions (1 to nf)
 1.0 0.0 0.0 0.0
$ initial temperatures (4 fluids)
 372.69 372.69 372.69 372.69
$ initial fluid axial velocities (1 to nf)
 0.0 2*0.0 0.0
$ initial fluid radial velocities (1 to nf)
 4*0.0
$ volume fraction equivalent to zero
 1.e-16
$*** end fluid ic section
$*** vessel geometry
$ axial length of cell (m)
 40*0.0075,
 40*0.0075
 8*0.065, 8*0.060

```

```

$ location of radial nodes, 1 to nrp1 (1 = 0.0)
  0.0 0.02 0.04 0.06 0.07875 0.0975 0.11625 0.135 0.15375 0.1725 0.19125 0.21
$ additional embedded interface cell connections
  0
$ *** structures input
$ structure input table size, convergence criteria, iterations
$ this has maxmod=0 to turn off structures input
$ 0 1.0e-6 1.0e-6 10 10
$*** end structures
$ *** radiation input
$ number of radiation groups
1
$ max number of iterations
50
$ convergence criteria
1.0e-5
$ tbound
300.
$ emissivities
0.3 0.3 0.3 0.3 0.3 0.8
$ mass absorption coefficient
4*0.1
$ *** end radiation
$ *** debris data
0
5 1 2
0.8 0.70 0.08 0.0045 0.0
$ *** end debris
$ *** end input deck ***
$
```

Appendix I: Input deck to KROTOS-26

```
KROTOS-26 IFCI6.0f outer cylinder included
$ SCOPING CALCULATION
$ begin general input section
$ restart file (1=yes,0=no)
0
$ time intervals
$ dump plot edit
5.e-1 2.0e-2 5.e-1
$ number of steps for main print (iprint>0)
1
$ print flags (3)
1 0 0
$ number of axial mesh cells
148
$ number of radial rings
7
$ radiation time step control (gascoef)
0.02
$ start time in sec
0.00
$ problem end time
2.00
$ initial time step
1.0e-8
$ number of entries (ntim) in table of maximum timestep versus time
2
$ entries in maximum time step table (ntim * (time, max time))
0.0 1.0e-3 25.0 1.0e-3
$***end general input section
$ begin fluids input
$ time step increase factor (if no other time step limitations present)
1.05
$ minimum time step
1.e-10
$ courant number to limit time step
0.25
$ minimum iterations to allow timestep increase
5
$ maximum iterations before failure
25
$ convergence error in pressure iteration (error1)
1.0e-7
$ maximum allowable relative change in volume fraction per time step
0.250
$ maximum allowable relative change in temperature per time step
0.050
$ condensation coefficient
```

```

1.0
$ initial field 3 diameter dcor1
$ data irrelevant (field 3 not used)
$ 0.0300
  0.007
$ initial field 4 diameter dcor2
$ data from I.92.115 jet nozzle diameter = 30mm
$ 0.030
  0.007
$ material id's (8 #s)
$ Al2O3(#21)
  21  7*0
$ reference mass fractions for fields 3 and 4 (8 #s)
  1.00  7*0.0
$ reference pressure
  0.1e6
$ reference temperatures for fields 3 and 4 (2 #s)
  2570.0  2570.0
$ inverse sound speed squared for fields 3 and 4 (2 #s)
$ same as default
  2*1.0e-4
$ detonation flag and model selector
  0    0    1
$ type 0 flag
$ 16   1    0.01
$ type 1 flag
$ 10.0e6
$ type 2 flag
$ 0.01  0.001
$ fragmentation data (to be input only if det model used)$
$ 0.001  0.00001  0    10.
$ number of time steps for minor print to ntty (1 line)
  50
$ IIOUT, info print control (0 cycles thru)
  8
$ *** ADDITIVE FRICTION FACTORS
$ number of additive regions
  4
$ region 1 domain
  5,1,5,108
$ Additive axial friction factor at top of node for field 1 (vapor)
  40*0.0
  40*0.0
  28*0.0
$ Additive axial friction factor at top of node for field 2 (water)
  40*0.0
  40*0.0
  28*0.0
$ Additive axial friction factor at top of node for field 3
  40*0.0
  40*0.0
  28*0.0
$ Additive axial friction factor at top of node for field 4 (melt)
  40*0.0
  40*0.0

```

```

28*0.0
$ Additive axial friction factor at rhs of node for field 1 (vapor)
40*1.e21
40*1.e21
28*1.e21
$ Additive axial friction factor at rhs of node for field 2 (water)
40*1.e21
40*1.e21
28*1.e21
$ Additive axial friction factor at rhs of node for field 3
40*1.e21
40*1.e21
28*1.e21
$ Additive axial friction factor at rhs of node for field 4 (melt)
40*1.e21
40*1.e21
28*1.e21
$ region 2 domain
6,108,7,108
$ Additive axial friction factor at top of node for field 1 (vapor)
1.e21
1.e21
$ Additive axial friction factor at top of node for field 2 (water)
1.e21
1.e21
$ Additive axial friction factor at top of node for field 3
1.e21
1.e21
$ Additive axial friction factor at top of node for field 4 (melt)
1.e21
1.e21
$ Additive axial friction factor at rhs of node for field 1 (vapor)
0.0
0.0
$ Additive axial friction factor at rhs of node for field 2 (water)
0.0
0.0
$ Additive axial friction factor at rhs of node for field 3
0.0
0.0
$ Additive axial friction factor at rhs of node for field 4 (melt)
0.0
0.0
$ region 3 domain
5,126,5,148
$ Additive axial friction factor at top of node for field 1 (vapor)
23*0.0
$ Additive axial friction factor at top of node for field 2 (water)
23*0.0
$ Additive axial friction factor at top of node for field 3
23*0.0
$ Additive axial friction factor at top of node for field 4 (melt)
23*0.0
$ Additive axial friction factor at rhs of node for field 1 (vapor)
23*1.e21
$ Additive axial friction factor at rhs of node for field 2 (water)
23*1.e21
$ Additive axial friction factor at rhs of node for field 3
23*1.e21
$ Additive axial friction factor at rhs of node for field 4 (melt)

```

```

23*1.e21
$ region 4 domain
2,132,2,148
$ Additive axial friction factor at top of node for field 1 (vapor)
17*0.0
$ Additive axial friction factor at top of node for field 2 (water)
17*0.0
$ Additive axial friction factor at top of node for field 3
17*0.0
$ Additive axial friction factor at top of node for field 4 (melt)
17*0.0
$ Additive axial friction factor at rhs of node for field 1 (vapor)
17*0.0
$ Additive axial friction factor at rhs of node for field 2 (water)
17*1.e21
$ Additive axial friction factor at rhs of node for field 3
17*1.e21
$ Additive axial friction factor at rhs of node for field 4 (melt)
17*1.e21
$*** end additive friction
$
$*** INFLOW BOUNDARYIES
$
$ ATTEMPT 1 to simulate exploding trigger
$
$ number of locations of inflow boundary conditions (ninbc)
1
$ radial ring of inflow condition
1
$ axial location (KMAX+1 for top, 0 for bottom)
0
$ inflow area
0.0015
$ number of pressure entires
24
$ number of velocity entires
24
2
2
$ time/pressure table
0 1.00E+5 2 1.00E+5 2.000001 1.1135E+7
2.000073 1.026E+7 2.000153 8.86E+6 2.000217 7.39E+6
2.000265 6.235E+6 2.000313 5.29E+6 2.000377 4.59E+6
2.000505 3.96E+6 2.000617 3.33E+6 2.000761 3.19E+6
2.000897 2.735E+6 2.000977 2.42E+6 2.001105 2.875E+6
2.001217 2.385E+6 2.001393 1.79E+6 2.001465 2.175E+6
2.001569 2.315E+6 2.001609 2.245E+6 2.001697 2.63E+6
2.001873 2.56E+6 2.001873 1.1135E+7 100 1.1135E+7

$ time/hydrogen pressure table
0 1.00E+5 2 1.00E+5 2.000001 1.1135E+7
2.000073 1.026E+7 2.000153 8.86E+6 2.000217 7.39E+6
2.000265 6.235E+6 2.000313 5.29E+6 2.000377 4.59E+6
2.000505 3.96E+6 2.000617 3.33E+6 2.000761 3.19E+6
2.000897 2.735E+6 2.000977 2.42E+6 2.001105 2.875E+6
2.001217 2.385E+6 2.001393 1.79E+6 2.001465 2.175E+6
2.001569 2.315E+6 2.001609 2.245E+6 2.001697 2.63E+6
2.001873 2.56E+6 2.001874 1.0E+5 100 1.0E+5

$fluid 1

```

```

$ 0.0 0.0 0.0001 10.0 0.0011 2.0 0.0012 0.0 100.0 0.0
0.0 0.0 2.0 0.0 2.000001 11.135 2.000073 10.26
2.000153 8.86 2.000217 7.39 2.000265 6.235
2.000313 5.29 2.000377 4.59 2.000505 3.96
2.000617 3.33 2.000761 3.19 2.000897 2.735
2.000977 2.42 2.001105 2.875 2.001217 2.385
2.001393 1.79 2.001465 2.175 2.001569 2.315
2.001609 2.245 2.001697 2.63 2.001873 2.56
2.001874 0.0 100 0.0
0.0 332.69 100.0 332.69
0.0 1.0 100.0 1.0
$fluid 2
$ 0.0 0.0 0.0001 10.0 0.0011 2.0 0.0012 0.0 100.0 0.0
0.0 0.0 2.0 0.0 2.000001 0.0 2.000073 0.0
2.000153 0.0 2.000217 0.0 2.000265 0.0
2.000313 0.0 2.000377 0.0 2.000505 0.0
2.000617 0.0 2.000761 0.0 2.000897 0.0
2.000977 0.0 2.001105 0.0 2.001217 0.0
2.001393 0.0 2.001465 0.0 2.001569 0.0
2.001609 0.0 2.001697 0.0 2.001873 0.0
2.001874 0.0 100 0.0
0.0 332.69 100.0 332.69
0.0 0.0 100.0 0.0
$fluid 3
$ 0.0 0.0 0.0001 10.0 0.0011 2.0 0.0012 0.0 100.0 0.0
0.0 0.0 2.0 0.0 2.000001 0.0 2.000073 0.0
2.000153 0.0 2.000217 0.0 2.000265 0.0
2.000313 0.0 2.000377 0.0 2.000505 0.0
2.000617 0.0 2.000761 0.0 2.000897 0.0
2.000977 0.0 2.001105 0.0 2.001217 0.0
2.001393 0.0 2.001465 0.0 2.001569 0.0
2.001609 0.0 2.001697 0.0 2.001873 0.0
2.001874 0.0 100 0.0
0.0 332.69 100.0 332.69
0.0 0.0 100.0 0.0
$fluid 4
$ 0.0 0.0 0.0001 10.0 0.0011 2.0 0.0012 0.0 100.0 0.0
0.0 0.0 2.0 0.0 2.000001 0.0 2.000073 0.0
2.000153 0.0 2.000217 0.0 2.000265 0.0
2.000313 0.0 2.000377 0.0 2.000505 0.0
2.000617 0.0 2.000761 0.0 2.000897 0.0
2.000977 0.0 2.001105 0.0 2.001217 0.0
2.001393 0.0 2.001465 0.0 2.001569 0.0
2.001609 0.0 2.001697 0.0 2.001873 0.0
2.001874 0.0 100 0.0
0.0 332.69 100.0 332.69
0.0 0.0 100.0 0.0
$volume fraction
$ 1.00 7*0.0
$ 1.00 7*0.0
$ 
$ *** end of inlet bc section *****
$ 
$ *** OUTFLOW BOUNDARY CONDITIONS *****
$ 
$ Flow areas are areas of each annulus at top of problem domain.
$ HDs are delta-r's of each ring.
$ 
$ number of locations for outlet pressure boundaries (npbc)
$ Exact modeling would include 14

```

```

4
$ boundary location flag (1=radial;2=axial)
1
$ radial location of outlet bc
126
$ flow area for pressure bc
1.953547E-2
$ hydraulic diameter for pressure bc
0.04
$ number of entries in outlet pressure boundary condition table (nprout)
2
$ outlet pressure vs time (nprout*(time,press))
0.0 0.10e6 100.0 0.10e6
$ boundary location flag (1=radial;2=axial)
1
$ radial location of outlet bc
127
$ flow area for pressure bc
1.953547E-2
$ hydraulic diameter for pressure bc
0.04
$ number of entries in outlet pressure boundary condition table (nprout)
2
$ outlet pressure vs time (nprout*(time,press))
0.0 0.10e6 100.0 0.10e6
$ boundary location flag (1=radial;2=axial)
1
$ radial location of outlet bc
128
$ flow area for pressure bc
1.953547E-2
$ hydraulic diameter for pressure bc
0.04
$ number of entries in outlet pressure boundary condition table (nprout)
2
$ outlet pressure vs time (nprout*(time,press))
0.0 0.10e6 100.0 0.10e6
$ boundary location flag (1=radial;2=axial)
1
$ radial location of outlet bc
129
$ flow area for pressure bc
1.953547E-2
$ hydraulic diameter for pressure bc
0.04
$ number of entries in outlet pressure boundary condition table (nprout)
2
$ outlet pressure vs time (nprout*(time,press))
0.0 0.10e6 100.0 0.10e6
$
$*** end outlet bc section
$ the following cards (to the end of fluids in) not included in restart
$*** fluid region input
$ number of fluid regions
5
1 1 5 108
$ initial system pressure (spatially uniform)
0.1e6
$ initial hydrogen partial pressure
0.08006e6

```

```

$ initial fluid volume fractions (1 to nf)
  0.0001 0.9999  0.0  0.00
$ initial temperatures (4 fluids)
  4*332.69
$ initial fluid axial velocities (1 to nf)
  4*0.0
$ initial fluid radial velocities (1 to nf)
  4*0.0
$ FLUID REGION 2 (BLANK REGION)
  6 1 7 108
$ initial system pressure (spatially uniform)
  0.1e6
$ initial hydrogen partial pressure
  0.08006e6
$ initial fluid volume fractions (1 to nf)
  1.0 0.0 0.0  0.0
$ initial temperatures (4 fluids)
  4*332.69
$ initial fluid axial velocities (1 to nf)
  4*0.0
$ initial fluid radial velocities (1 to nf)
  4*0.0
$ FLUID REGION 3 (WATER INCLUDING OUTER CHAMBER)
  1 109 7 117
$ initial system pressure (spatially uniform)
  0.1e6
$ initial hydrogen partial pressure
  0.08006e6
$ initial fluid volume fractions (1 to nf)
  0.0001 0.9999  0.0  0.0
$ initial temperatures (4 fluids)
  4*332.69
$ initial fluid axial velocities (1 to nf)
  4*0.0
$ initial fluid radial velocities (1 to nf)
  4*0.0
$ FLUID REGION 4 (VAPOR)
  1 118 7 148
$ initial system pressure (spatially uniform)
  0.1e6
$ initial hydrogen partial pressure
  0.08006e6
$ initial fluid volume fractions (1 to nf)
  1.0 0.0 0.0  0.0
$ initial temperatures (4 fluids)
  4*332.69
$ initial fluid axial velocities (1 to nf)
  4*0.0
$ initial fluid radial velocities (1 to nf)
  4*0.0
$ FLUID REGION 5 (MELT)
  1 132 2 148
$ initial system pressure (spatially uniform)
  0.1e6
$ initial hydrogen partial pressure
  0.08006e6
$ initial fluid volume fractions (1 to nf)
  0.01 0.0 0.0  0.99
$ field 4 mass fractions (same as inflow BC)
  1.00 7*0.0

```

```

$ initial temperatures (4 fluids)
2573.0 332.69 2*2573.0
$ initial fluid axial velocities (1 to nf)
4*0.0
$ initial fluid radial velocities (1 to nf)
4*0.0
$ volume fraction equivalent to zero
1.e-16
$*** end fluid ic section
$*** vessel geometry
$ axial length of cell (m)
9*0.01, 21*0.00952381,
21*0.00952381,
21*0.00952381,
21*0.00952381,
6*0.0095, 9*0.00955556, 9*0.00966667, 8*0.029125,
6*0.03033333, 17*0.02864706
$
$ location of radial nodes, 1 to nrp1 (1 = 0.0)
0.0 0.0075 0.015 0.025 0.035 0.0445, 0.07, 0.1025
$
$ additional embedded interface cell connections
0
$
$*** structures input
$
$ structure input table size, convergence criteria, iterations
$ this has maxmod=0 to turn off structures input
$
0 1.0e-6 1.0e-6 10 10
$*** end structures
$
$*** radiation input
$
$ number of radiation groups
1
$ max number of iterations
50
$ convergence criteria
1.0e-5
$ tbound
300.
$ emissivities
0.3 0.3 0.3 0.3 0.3 0.8
$ mass absorption coefficient
4*0.1
$
$*** end radiation
$*** debris data
0
5 1 2
0.8 0.70 0.08 0.0045 0.0
$
$*** end debris
$*** end input deck ***
$
```

Appendix J: Input deck for KROTOS-38

```
KROTOS-38 IFCI6.0 6x16 mesh (11/29/95)
$ SCOPING CALCULATION
$ begin general input section
$ restart file (1=yes,0=no)
0
$ time intervals
$ dump plot edit
2.3e-1 0.5e-2 1.e-2
$ number of steps for main print (iprint>0)
1
$ print flags (3)
1 0 0
$ number of axial mesh cells
16
$ number of radial rings
7
$ radiation time step control (gascoef)
0.02
$ start time in sec
0.00
$ problem end time
2.0
$ initial time step
1.0e-8
$ number of entries (ntim) in table of maximum timestep versus time
2
$ entries in maximum time step table (ntim * (time, max time))
0.0 1.0e-4 25.0 1.0e-4
$ ***end general input section
$ begin fluids input
$ time step increase factor (if no other time step limitations present)
1.05
$ minimum time step
1.e-10
$ courant number to limit time step
0.25
$ minimum iterations to allow timestep increase
5
$ maximum iterations before failure
100
$ convergence error in pressure iteration (error1)
1.0e-7
$ maximum allowable relative change in volume fraction per time step
0.05
$ maximum allowable relative change in temperature per time step
0.050
$ condensation coefficient
```

```

    1.0
$ initial field 3 diameter dcor1
$ data irrelevant (field 3 not used)
    0.030
$ initial field 4 diameter dcor2
$ data from I.92.115 jet nozzle diameter = 30mm
    0.030
$ material id's (8 #s)
$ Al2O3(#21)
    21  7*0
$ reference mass fractions for fields 3 and 4 (8 #s)
    1.00  7*0.0
$ reference pressure
    0.1e6
$ reference temperatures for fields 3 and 4 (2 #s)
    2665.0  2665.0
$ inverse sound speed squared for fields 3 and 4 (2 #s)
$ same as default
    2*1.0e-8
$ detonation flag and model selector
    0      0      1
$ type 0 flag
$ 16   1   0.01
$ type 1 flag
$ 10.0e6
$ type 2 flag
$ 0.01  0.001
$ fragmentation data (to be input only if det model used)$
$ 0.001  0.00001  0   10.
$ number of time steps for minor print to ntty (1 line)
    1
$ IIOUT, info print control (0 cycles thru)
    8
$ **** ADDITIVE FRICTION FACTORS
$ number of additive regions
    0
$**** end additive friction
$ **** INFLOW BOUNDARYIES
$ MELT INFLOW CONDITION
$ number of locations of inflow boundary conditions (ninbc)
    1
$ radial ring of inflow condition
    1
$ axial location (KMAX+1 for top, 0 for bottom)
    17
$ inflow area
    0.000706858
$ number of pressure entires
    2
$ number of velocity, temperature, volume fraction entires
    22
    2

```

```

4
$ time/pressure table
 0 1.00E+5 100 1.00E+5
$ time/hydrogen pressure table
 0 0.97513E+5 100 0.97513E+5
$fluid 1 (velocity, temp, vol. frac)
$ 0.0 0.0 100. 0.0
 0.00000 0.0 0.02330 0.0 0.04659 0.0 0.06989 0.0
 0.09319 0.0 0.11648 0.0 0.13978 0.0 0.16308 0.0
 0.18637 0.0 0.20967 0.0 0.23297 0.0 0.25626 0.0
 0.27956 0.0 0.30286 0.0 0.32615 0.0 0.34945 0.0
 0.37275 0.0 0.39604 0.0 0.41934 0.0 0.44264 0.0
 0.46593 0.0 100. 0.0
 0.0 294. 100.0 294.
 0.0 0.0 0.35 0.0 0.351 0.0 100.0 0.0
$fluid 2 (velocity, temp, vol. frac)
$ 0.0 0.0 100. 0.0
 0.00000 0.0 0.02330 0.0 0.04659 0.0 0.06989 0.0
 0.09319 0.0 0.11648 0.0 0.13978 0.0 0.16308 0.0
 0.18637 0.0 0.20967 0.0 0.23297 0.0 0.25626 0.0
 0.27956 0.0 0.30286 0.0 0.32615 0.0 0.34945 0.0
 0.37275 0.0 0.39604 0.0 0.41934 0.0 0.44264 0.0
 0.46593 0.0 100. 0.0
 0.0 294. 100. 294.
 0.0 0.0 0.35 0.0 0.351 0.0 100.0 0.0
$fluid 3 (velocity, temp, vol. frac)
$ 0.0 0.0 100.0 0.0
 0.00000 0.0 0.02330 0.0 0.04659 0.0 0.06989 0.0
 0.09319 0.0 0.11648 0.0 0.13978 0.0 0.16308 0.0
 0.18637 0.0 0.20967 0.0 0.23297 0.0 0.25626 0.0
 0.27956 0.0 0.30286 0.0 0.32615 0.0 0.34945 0.0
 0.37275 0.0 0.39604 0.0 0.41934 0.0 0.44264 0.0
 0.46593 0.0 100. 0.0
 0.0 2665. 100.0 2665.
 0.0 0.0 0.35 0.0 0.351 0.0 100.0 0.0
$fluid 4 (velocity, temp, vol. frac)
$ 0.0 -1.75 100.0 -1.75
 0.00000 2.88652 0.02330 2.46875 0.04659 2.23977 0.06989 2.10089
 0.09319 2.00872 0.11648 1.94189 0.13978 1.88923 0.16308 1.84462
 0.18637 1.80463 0.20967 1.76734 0.23297 1.73162 0.25626 1.69681
 0.27956 1.66255 0.30286 1.62862 0.32615 1.62120 0.34945 1.60531
 0.37275 1.55963 0.39604 1.48116 0.41934 1.35723 0.44264 1.14156
 0.46593 0.32126 100. 0.32126
 0.0 2665. 100.0 2665.
$ 0.0 1.0 0.35 1.0 0.351 0.0 100.0 0.0
 0.0 1.0 0.32126 1.0 0.3213 0.0 100.0 0.0
$volume fraction
 1.00 7*0.0
 1.00 7*0.0
$ **** end of inlet bc section *****
$ **** OUTFLOW BOUNDARY CONDITIONS *****
$ Flow areas are areas of each annulus at top of problem domain.
$ HDs are delta-r's of each ring.
$ 
$ number of locations for outlet pressure boundaries (npbc)
 1
$ boundary location flag (1=radial;2=axial)

```

```

2
$ radial location of outlet bc
7
$ flow area for pressure bc
0.0059690
$ hydraulic diameter for pressure bc
0.04
$ number of entries in outlet pressure boundary condition table (nprout)
2
$ outlet pressure vs time (nprout*(time,press))
0.0 0.10e6 100.0 0.10e6
$
$**** end outlet bc section
$ the following cards (to the end of fluids in) not included in restart
$*** fluid region input
$ number of fluid regions
2
$ FLUID REGION 1 (WATER)
1 1 7 11
$ initial system pressure (spatially uniform)
1.0e5
$ initial hydrogen partial pressure
0.975130e5
$ initial fluid volume fractions (1 to nf)
0.0001 0.9999 0.0 0.0
$ initial temperatures (4 fluids)
4*294.
$ initial fluid axial velocities (1 to nf)
0.0 2*0.0 0.0
$ initial fluid radial velocities (1 to nf)
4*0.0
$ FLUID REGION 2 (gas)
1 12 7 16
$ initial system pressure (spatially uniform)
1.0e5
$ initial hydrogen partial pressure
0.975130e5
$ initial fluid volume fractions (1 to nf)
1.0 0.0 0.0 0.0
$ initial temperatures (4 fluids)
4*294.
$ initial fluid axial velocities (1 to nf)
4*0.0
$ initial fluid radial velocities (1 to nf)
4*0.0
$ volume fraction equivalent to zero
1.e-16
$**** end fluid ic section
$*** vessel geometry
$ axial length of cell (m)
10*0.10 0.105 5*0.0920
$
$ location of radial nodes, 1 to nrp1 (1 = 0.0)
0.0 0.015 0.030 0.045 0.060 0.075 0.090 0.100
$
$ additional embedded interface cell connections
0
$
$*** structures input
$

```

```

$ structure input table size, convergence criteria, iterations
$ this has maxmod=0 to turn off structures input
$ 
$ 0 1.0e-6 1.0e-6 10 10
$*** end structures
$ 
$*** radiation input
$ 
$ number of radiation groups
1
$ max number of iterations
50
$ convergence criteria
1.0e-5
$ tbound
300.
$ emissivities
0.3 0.3 0.3 0.3 0.3 0.8
$ mass absorption coefficient
4*0.1
$ 
$*** end radiation
$*** debris data
0
5 1 2
0.8 0.70 0.08 0.0045 0.0
$ 
$*** end debris
$*** end input deck ***

```

Appendix K: Input deck for Iron Oxidation Experiment

```
Lloyd Nelson Single Drop Experiment, 5x12 grid
$ mel5 input data in free form
$ begin general input section
$ restart file (1=yes,0=no)
0
$ time intervals
$ dump plot edit
1.e-1 1.0e-3 2.e-3
$ number of steps for main print (iprnt>0)
1
$ print flags (3)
1 0 0
$ number of axial mesh cells
2
$ number of radial rings
1
$ radiation time step control (gascoef)
0.02
$ start time in sec
0.00
$ problem end time
0.100
$ initial time step
1.0e-8
$ number of entries (ntim) in table of maximum timestep versus time
3
$ entries in maximum time step table (ntim * (time, max time))
0.0 1.0e-5 0.1 1.0e-2 5. 1.0e-2
$***end general input section
$ begin fluids input
$ time step increase factor (if no other time step limitations present)
1.05
$ minimum time step
1.e-10
$ courant number to limit time step
0.25
$ minimum iterations to allow timestep increase
5
$ maximum iterations before failure
25
$ convergence error in pressure iteration (error1)
1.0e-7
$ maximum allowable relative change in volume fraction per time step
0.05
$ maximum allowable relative change in temperature per time step
0.050
$ condensation coefficient
1.0
```

```

$ oxidation switch
 1.0 3
$ initial field 3 diameter dcor1
$ data irrelevant (field 3 not used)
 0.003
$ initial field 4 diameter dcor2
 0.0051478330
$ material id's (8 #s)
$ Fe(#24)
 24 25 6*0
$ reference mass fractions for fields 3 and 4 (8 #s)
 1.00 7*0.0
$ reference pressure
 0.1e6
$ reference temperatures for fields 3 and 4 (2 #s)
 1800.0 1800.0
$ inverse sound speed squared for fields 3 and 4 (2 #s)
$ same as default
 2*1.0e-4
$ detonation flag and model selector
 0 0 0
$ number of time steps for minor print to ntty (1 line)
 50
$ IIOUT, info print control (0 cycles thru)
 8
$ **** ADDITIVE FRICTION FACTORS
$ number of additive regions
 0
$ *** end additive friction
$ **** INFLOW BOUNDARYIES
$ number of locations of inflow boundary conditions (ninbc)
 0
$ *** end of inlet bc section *****
$ **** OUTFLOW BOUNDARY CONDITIONS *****
$ Flow areas are areas of each annulus at top of problem domain.
$ HDs are delta-r's of each ring.
$ number of locations for outlet pressure boundaries (npbc)
 1
$ boundary location flag (1=radial;2=axial)
 2
$ radial location of outlet bc
 1
$ flow area for pressure bc
 3.1E-2
$ hydraulic diameter for pressure bc
 0.100
$ number of entries in outlet pressure boundary condition table (nprout)
 2
$ outlet pressure vs time (nprout*(time,press))
 0.0 0.10e6 100.0 0.10e6
$ *** end outlet bc section
$ the following cards (to the end of fluids in) not included in restart

```

```

$*** fluid region input
$ number of fluid regions
    2
$ FLUID REGION 1 (Fe Drop)
    1 1 1 1
$ initial system pressure (spatially uniform)
    0.1e6
$ initial hydrogen partial pressure (H2 prevents initial oxidation)
    0.09683e6
$ initial volume fractions
$ for use with effective radius (84.6 mm) and 0.05m length
    0.9999364652  0.0  0.0  0.0000635348
    0.0000001  0.9999353652  0.0  0.0000635348
$ for use with effective radius (84.6 mm) and 0.290 m length
    0.9999890457  0.0  0.0  0.0000109543
    0.0000000001  0.9999890456  0.0  0.0000109543
$ field 4 mass fractions (uses comp 1 = Fe)
    1.00  7*0.0
$ initial temperatures (4 fluids)
    1800. 298. 2*1800.
$ initial fluid axial velocities (1 to nf)
    4*(-0.58)
$4*0.0
$ initial fluid radial velocities (1 to nf)
    4*0.0
$ FLUID REGION 2 (vapor)
    1 2 1 2
$ initial system pressure (spatially uniform)
    0.1e6
$ initial hydrogen partial pressure
    0.09683e6
$ initial fluid volume fractions (1 to nf)
    1.0  3*0.0
$ initial temperatures (4 fluids)
    4*298.0
$ initial fluid axial velocities (1 to nf)
    4*0.0
$ initial fluid radial velocities (1 to nf)
    4*0.0
$ volume fraction equivalent to zero
    1.e-16
$*** end fluid ic section
$*** vessel geometry
$ axial length of cell (m)
    0.05,  0.006
$    0.290,  0.006
$-
$ location of radial nodes, 1 to nrp1 (1 = 0.0)
$    0.0  0.00225  0.005  0.01  0.015  0.02
$    0.0  0.2
$    0.0  0.1
$    0.0  0.0846
$-
$ additional embedded interface cell connections
    0
$-
$*** structures input
$-
$ structure input table size, convergence criteria, iterations
$ this has maxmod=0 to turn off structures input

```

```
$  
0 1.0e-6 1.0e-6 10 10  
$*** end structures  
$  
$*** radiation input  
$  
$ number of radiation groups  
1  
$ max number of iterations  
50  
$ convergence criteria  
1.0e-5  
$ tbound  
300.  
$ emissivities  
0.3 0.3 0.3 0.3 0.3 0.8  
$ mass absorption coefficient  
4*0.1  
$  
$*** end radiation  
$*** debris data  
0  
5 1 2  
0.8 0.70 0.08 0.0045 0.0  
$  
$*** end debris  
$*** end input deck ***  
$
```

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